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PUBLISHED SEPARATELY

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
TOWN OF GOSHEN, NEW YORK

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Goshen, Orange County, New York, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Goshen to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Andrews & Clark, Inc., for FEMA, under Contract No. H-6810. This work was completed in April 1983.

1.3 Coordination

An initial Consultation and Coordination Officer's (CCO) meeting was held on June 4, 1979 and was attended by Town of Goshen officials, representatives of FEMA and the study contractor. The purpose of this meeting was to explain Flood Insurance Study procedures and to determine study limits.

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A meeting was held on January 27, 1981 between town officials and Andrews & Clark, Inc., (the study contractor) to review study limits established at the June 4, 1979 meeting and to obtain community input useful in the completion of the study.

Preliminary flood boundary delineations were presented by the study contractor for comment at a meeting held on April 6, 1983. This meeting was attended by representatives of The New York Department of Environmental Conservation and the Town of Goshen.

A search for basic data was made at all levels of government. Requested information included historical records of flooding, stream flow records and other published or unpublished reports detailing flood conditions within the study area. On December 5, 1984, the results of the study were reviewed with representatives of FEMA, the Town of Goshen, the New York Department of Environmental Conservation, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Goshen, Orange County, New York. The following areas are within the corporate limits but are areas not included in this flood study: Village of Goshen, Town of Goshen Park, Mid-Hudson Psychiatric Center, Orange County Sanitary Landfill, B.O.C.E.S., Orange Farm, New York State Training School Annex, Village of Florida Sewage Treatment Plant, Goshen Village Reservoir, and Green Hills Reservoir. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed study in Goshen were determined by FEMA with community and study contractor consultation at the meeting June 4, 1979. Floods caused by the overflow of Wallkill River, Rio Grande, Quaker Creek, Brown Creek, Otter Kill, Otter Kill Tributary 12, and Black Meadow Creek within the Goshen corporate limits were studied in detail.

Approximate methods of analyses were used to study those areas having a low development potential or a minimal flood hazard. All areas not designated for study by detailed methods were included in the approximate study. These areas included unnamed tributaries of the Rio Grande and Otter Kill as well as the portion of Quaker Creek downstream of the limits of detailed study at Pulaski Highway.

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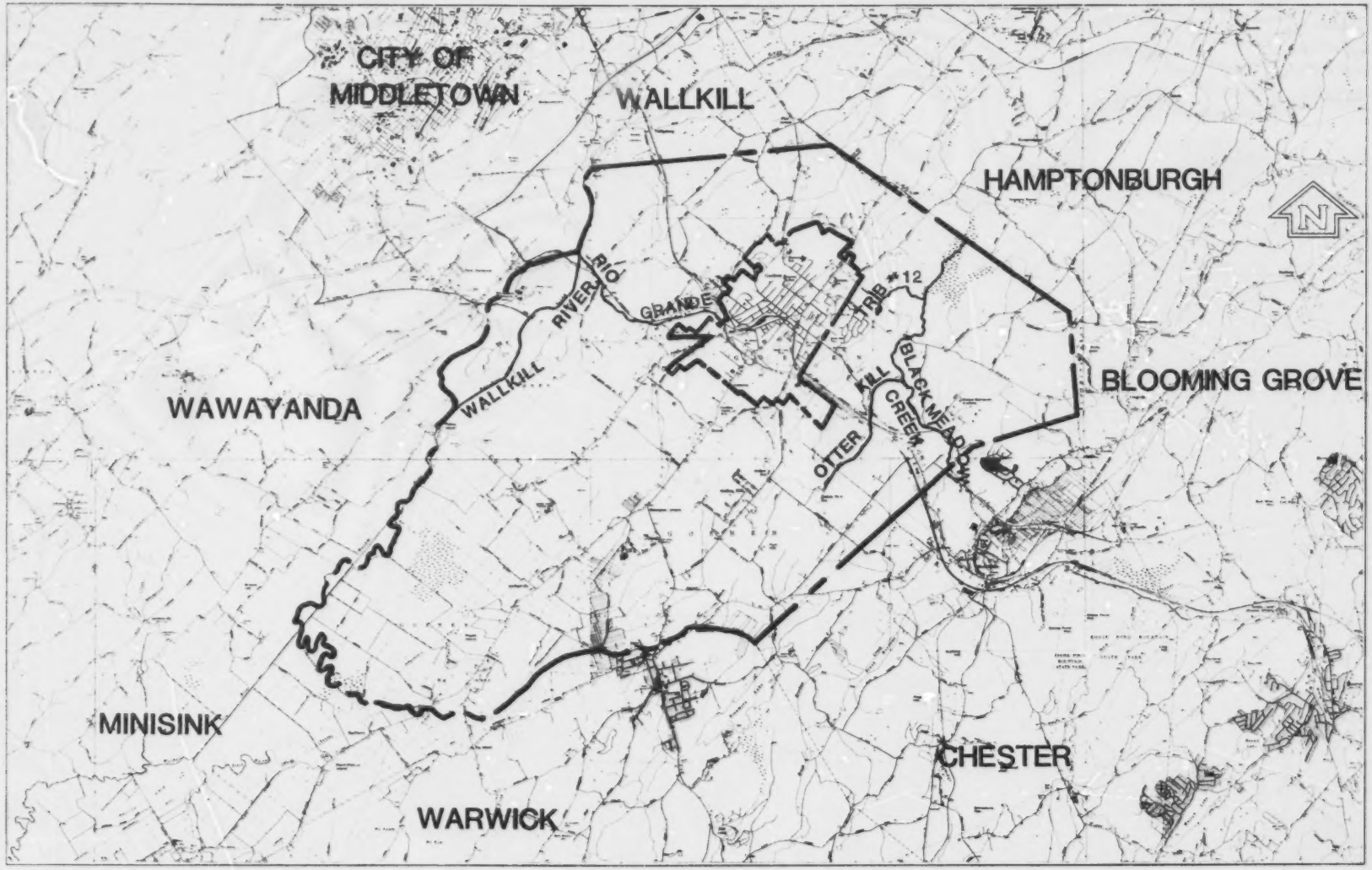

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

APPROXIMATE SCALE

10000 0 10000 20000 30000 FEET

VICINITY MAP

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The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction for the next five years, through May 1986. The scope and methods of the study were proposed and agreed upon by FEMA and the Town of Goshen.

2.2 Community Description

The Town of Goshen, located in southeastern New York State, is in the central portion of Orange County. The town is bordered by the Town of Wallkill on the north; the Town of Hamptonburgh on the northeast; the Town of Blooming Grove on the east; the Town of Chester on the southeast; the Town of Warwick on the south; and the Town of Wawayanda on the west. Located within the corporate limits of the Town of Goshen is the Village of Goshen, which is an area not included in the detailed study of the Town of Goshen. Goshen is approximately 50 miles north of New York City and 94 miles southeast of Binghamton. Goshen has an area of 44.56 square miles with a population of 10,463, as reported by the 1980 Census (Reference 1). The Orange County Planning Department has projected a 1985 population of 12,700 for the town (Reference 2).

The climate of the Town of Goshen is one of long summers and short winters. The average annual temperature is approximately 50 degrees Fahrenheit, with extremes varying from 24 degrees below zero to 106 degrees above. The average annual precipitation for the area is approximately 45 inches with observed annual extremes ranging from 29.54 to 68.31 inches. The distribution of precipitation throughout the year is fairly uniform, with slightly higher amounts during the summer months (Reference 3).

2.3 Principal Flood Problems

Notable floods on the Wallkill River occurred in 1894, 1903, 1927, 1928, 1933, 1936, 1948, 1955, 1968, 1970 and 1972. The highest recorded floods occurred in August and October 1955. The August 1955 flood was the result of Hurricane Diane (August 17-20, 1955). The highest recorded flood on Quaker Creek occurred in September 1938. During contacts with government officials and interviews with residents, areas of problem flooding were discussed. Flooding in the area of a subdivision south of Route 17 on Otter Kill was noted with an indication that a sewer pumping station had been flooded. Low lying areas near the Rio Grande were also noted as flood prone areas. Field reconnaissance has indicated that low lying areas adjacent to Quaker Creek and Black Meadow Creek are subject to flooding.

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2.4 Flood Protection Measures

The Town of Goshen does not maintain any structural flood control measures but does provide for the cleaning of drainage structures and culverts on a periodic basis. The town also regulates land use in the flood plain areas.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval), have been selected as having special significance for flood plain and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analysis

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail in the Town of Goshen.

Peak discharges for the Wallkill River were determined using a drainage area/discharge transfer technique for determination of flood discharges at ungaged locations on gaged watersheds. This hydrologic analysis was prepared in accordance with methods developed by the United Stated Geological Survey (USGS) (Reference 4).

Peak discharges for Quaker Creek were determined using a drainage area/discharge transfer technique based on methods developed by the Soils Conservation Service (SCS) (Reference 5) using gage information recorded by the USGS (Reference 4).

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Peak discharges for the Rio Grande, Brown Creek, Otter Kill, Otter Kill Tributary 12 and Black Meadow Creek were developed using a regression analysis based on stream flow records from eighteen stream gaging stations in the Orange County area as published by the United States Geological Survey (USGS) (Reference 4). The selected gages had periods of record ranging from 1 to 65 years. The regression analysis was prepared in accordance with methods determined by the United States Water Resources Council (Reference 6). The analysis considered the log-Pearson Type III coefficients of skew, mean and standard deviation in the establishment of peak discharges for this Flood Insurance Study.

Peak discharges developed for the Wallkill River and Quaker Creek were verified using information published in USGS Bulletin #72, which contains the maximum known stages and discharges of New York Streams through 1973 (Reference 7).

A summary of drainage area-peak discharge relationships developed for the Wallkill River, Rio Grande, Quaker Creek, Brown Creek, Otter Kill, Otter Kill Tributary 12, and Black Meadow Creek are shown in Table 1, "Summary of Discharges."

Table 1 - Summary of Discharges

Flooding Source - Locations	Drainage Area (SQ.MI.)	Peak Discharges (cfs) 10-yr	50-yr	100-yr	500-yr
WALLKILL RIVER					
Downstream Corporate Limits	419	7508	11315	13216	17219
Confluence of Monhagen Brook	401	7117	10638	12372	15878
Confluence of the Rio Grande	393	6958	10360	12025	15324
RIO GRANDE					
Confluence with Wallkill River	8.99	711	1357	1744	3008
Confluence of Cheechunk Creek	6.03	527	1019	1316	2296
Confluence of Station Road Tributary	3.69	365	716	930	1644

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Table 1 - Summary of Discharges - continued

Flooding Source - Locations	Drainage Area (SQ.MI.)	Peak Discharges (cfs) 10-yr	50-yr	100-yr	500-yr
QUAKER CREEK					
Pulaski Highway	26.86	2370	3780	4503	5982
Confluence of Wheeler Creek	17.84	1473	2350	2800	3719
Jessup Switch Road Bridge	9.91	736	1174	1398	1858
BROWN CREEK					
Downstream Corporate Limits	5.18	470	914	1183	2070
1700' East of Route 94	4.74	440	856	1109	1945
OTTER KILL					
Downstream Corporate Limits	21.09	1348	2502	3182	5364
Confluence of Otter Kill Tributary 12	16.79	1141	2133	2719	4608
Confluence of Black Meadow Creek	2.27	253	505	661	1183
OTTER KILL TRIBUTARY 12					
Confluence with Otter Kill	1.92	223	448	587	1056
BLACK MEADOW CREEK					
Confluence with Otter Kill	13.88	985	1853	2369	4039

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in Goshen were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along the flooding sources.

The cross sections used for backwater analysis as well as elevation data and structural geometry for all bridges and culverts on the Wallkill River, Quaker Creek, Otter Kill, Otter Kill Tributary 12, and Black Meadow Creek were obtained from hydraulic models

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developed for Flood Plain Information reports prepared for the respective streams (Reference 8,9,10). This information was verified by a field survey performed by the study contractors.

The overbank areas of cross sections for the backwater analysis of the Rio Grande and Brown Creek were obtained from aerial photographs flown in December 1980 at a scale of 1:9600 (Reference 11). The channel sections were based on field survey data. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the original hydraulic models for the Wallkill River, Quaker Creek, Otter Kill, Otter Kill Tributary 12 and Black Meadow Creek were verified by field reconnaissance to insure accurate representation of currently existing conditions in flood plain areas. Roughness factors for the Rio Grande and Brown Creek were chosen by engineering judgement and based on field observations of stream and flood plain areas.
Water-surface elevations of floods of the selected recurrence intervals were computed using the U.S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 12). Flood profiles were drawn showing computed water surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Wallkill River were based on flood profiles prepared for the Town of Wallkill Flood Insurance Study (Reference 13). Starting water-surface elevations for Brown Creek were based on flood profiles prepared for the Village of Florida Flood Insurance Study (Reference 14). Starting water-surface elevations for Otter Kill were based on flood profiles prepared for the Town of Hamptonburgh Flood Insurance Study (Reference 15). Starting water-surface elevations for the Rio Grande, Quaker Creek, Otter Kill Tributary 12, and Black Meadow Creek were calculated using the slope-area method. All elevations are referenced from the National Geodetic Vertical Datum of 1929, (NGVD) formerly referred to a Sea Level Datum of 1929; elevation reference marks used in this study are shown on the maps.

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The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as a base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4800 with a contour interval of 4 feet (Reference 16). In cases where the 100- and the 500-year flood boundaries are close together or collinear only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of the floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of stream plus any adjacent flood plain areas

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that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map, (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown. A portion of the floodway of the Wallkill River, Quaker Creek, and Brown Creek are outside the corporate limits.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the Town of Goshen.

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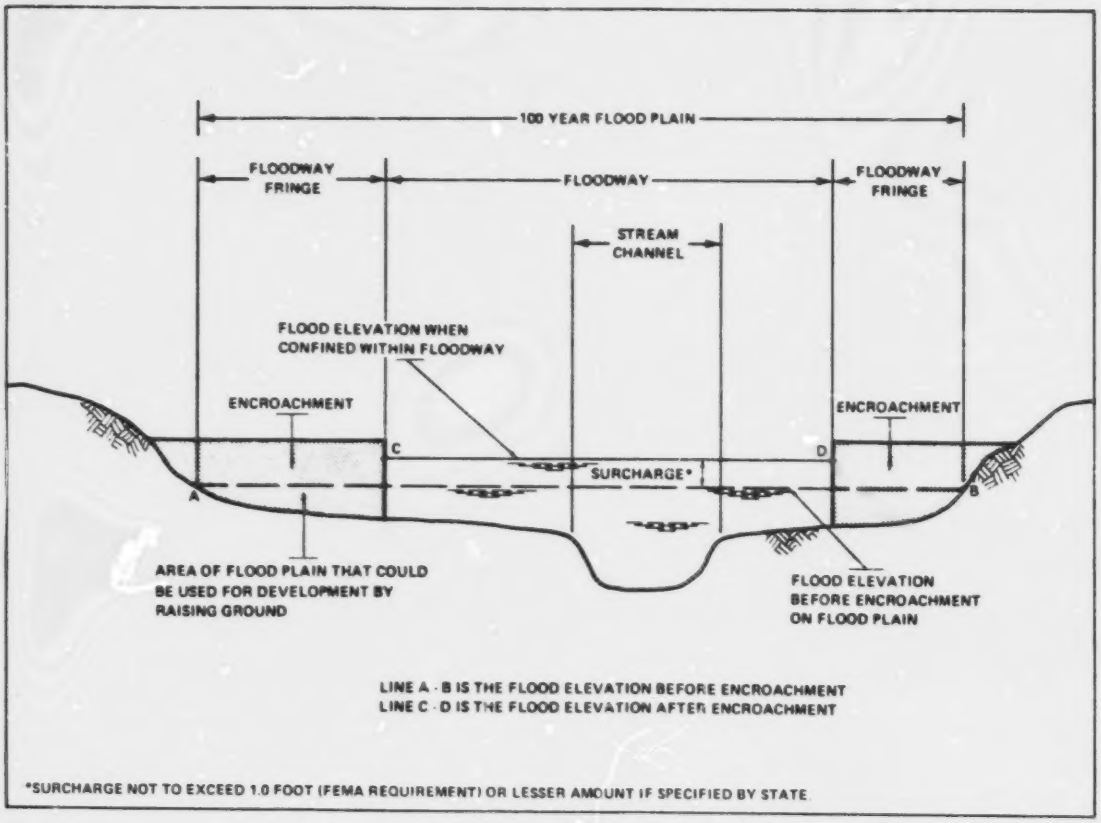
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

The location of the reaches determined for the Town of Goshen are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	TOTAL WIDTH/ WIDTH WITHIN CORP. LIMITS.	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
WALLKILL RIVER								
A	200	1077/450	8810	1.6	366.5	366.5	367.5	1.0
B	2525	509/250	4801	2.8	366.9	366.9	367.9	1.0
C	5000	1542/ 85	10268	1.2	367.7	367.7	368.7	1.0
D	6450	420	2798	4.3	368.2	368.2	369.1	0.9
E	7650	90	1342	9.0	370.9	370.9	371.5	0.6
F	9950	100	2169	5.5	373.6	373.6	374.6	1.0
G	12475	120	3527	3.4	375.2	375.2	376.2	1.0
H	13100	60	1968	6.1	375.4	375.4	376.4	1.0
I	15575	60	2122	5.7	377.1	377.1	378.0	0.9
J	18025	60	2444	4.9	379.0	379.0	379.9	0.9
K	20025	60	3178	3.8	380.0	380.0	381.0	1.0
L	22825	115/70	5027	2.4	381.0	381.0	382.0	1.0

[1] FEET ABOVE CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

WALLKILL RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
RIO GRANDE								
A	1070	80	522	3.3	368.3	365.9[2]	365.9	0.0
B	1920	100	699	2.5	371.2	371.2	371.2	0.0
C	2290	120	926	1.9	372.0	372.0	372.0	0.0
D	4095	100	707	2.5	376.7	376.7	376.7	0.0
E	6125	100	929	1.4	376.9	376.9	377.3	0.4
F	7800	100	805	1.6	376.9	376.9	377.6	0.7
G	9490	130	1022	1.3	379.9	379.9	379.9	0.0
H	11165	100	700	1.3	380.0	380.0	380.2	0.2
I	12315	49	263	3.5	380.0	380.0	380.7	0.7
J	13645	100	808	1.2	394.2	394.2	394.2	0.0
K	14777	100	375	2.5	412.5	412.5	412.5	0.0

[1] FEET ABOVE CONFLUENCE WITH WALLKILL RIVER
[2] BACKWATER EFFECTS FROM WALLKILL RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY
(ORANGE CO.)

FLOODWAY DATA

RIO GRANDE

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	TOTAL WIDTH/ WIDTH WITHIN CORP.LIMITS	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
QUAKER CREEK								
A	1750	110/ 50	1006	4.5	386.3	386.3	387.2	0.9
B	3200	1055/220	6111	0.7	386.9	386.9	387.9	1.0
C	4920	1154/105	7880	0.6	387.0	387.0	388.0	1.0
D	9110	1148/440	7828	0.6	387.2	387.2	388.2	1.0
E	13780	1535/700	9312	0.3	387.4	387.4	388.4	1.0
F	16660	47/ 30	454	3.1	387.8	387.8	388.8	1.0
G	18580	31	204	6.9	390.3	390.3	391.1	0.8

[1] FEET ABOVE LIMIT OF DETAILED STUDY

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

QUAKER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	TOTAL WIDTH/ WIDTH WITHIN CORP. LIMITS	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
BROWN CREEK								
A	1630	350/70	1192	1.0	406.9	406.9	407.0	0.1
B	3110	50/25	380	3.1	424.9	424.9	424.9	0.0
C	4320	100/50	818	1.4	440.0	440.0	440.0	0.0
D	4360	120/75	816	1.4	442.6	442.6	442.6	0.0
E	4810	100/60	491	2.3	444.4	444.4	444.6	0.2
F	5555	50/35	214	5.2	444.9	444.9	445.2	0.3
G	7260	200/110	1364	0.8	446.6	446.6	447.1	0.5
H	8275	200/100	883	1.3	446.6	446.6	447.3	0.7

[1] FEET ABOVE CONFLUENCE WITH QUAKER CREEK

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

BROWN CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
OTTER KILL								
A	2345	360	685	4.6	366.1	366.1	366.8	0.7
B	9655	220	1526	1.8	374.4	374.4	374.8	0.4
C	12355	460	3368	0.8	376.3	376.3	377.2	0.9
D	13805	455	1055	2.6	378.9	378.9	378.9	0.0
E	14645	45	147	4.5	380.8	380.8	380.9	0.1
F	16165	35	125	5.3	394.8	394.8	395.3	0.5
G	17125	30	180	3.7	400.4	400.4	401.1	0.7
H	18230	130	931	0.7	408.2	408.2	408.7	0.5
I	19115	450	4185	0.2	410.2	410.2	411.0	0.8
J	22205	65	242	2.7	410.8	410.8	411.8	1.0
K	23190	100	495	1.3	424.6	424.6	424.9	0.3

[1] FEET ABOVE CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

OTTER KILL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
OTTER KILL TRIBUTARY 12								
A	2200	70	207	2.8	373.2	373.2	374.0	0.8
B	4085	140	472	1.2	381.7	381.7	381.7	0.0
C	4480	80	95	6.2	387.6	387.6	387.6	0.0
D	5746	85	531	1.1	397.6	397.6	397.6	0.0

[1] FEET ABOVE CONFLUENCE WITH OTTER KILL

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

OTTER KILL TRIBUTARY 12

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
BLACK MEADOW CREEK								
A	1170	460	3050	0.8	379.5	379.5	380.4	0.9
B	3865	200	1032	2.3	387.0	387.0	387.3	0.3
C	5825	80	499	4.7	403.3	403.3	403.3	0.0
D	8430	310	1498	1.6	404.4	404.4	404.8	0.4

[1] FEET ABOVE CONFLUENCE WITH OTTER KILL

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOODWAY DATA

BLACK MEADOW CREEK

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005 if the difference is 1.4 feet, the FHF is 015, if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of Goshen was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods, no base flood elevations shown or flood hazard factors determined.
Zone A3,A4,A5, A7,A8:	Special Flood Hazard Area inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot or, areas subject to 100-year flooding from sources with drainage areas of less than one square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

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FLOODING SOURCE	PANEL [1]	ELEVATION DIFFERENCE [2] BETWEEN 1.0% (100 YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION [3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Wallkill River							
Reach 1	05	-4.2	-1.3	3.8	040	A8	Varies
Rio Grande							
Reach 1	05	-2.3	-0.8	2.5	025	A5	371
Reach 2		-1.3	-0.5	2.4	015	A3	Varies
Reach 3		-3.8	-1.0	3.4	040	A8	Varies
Quaker Creek							
Reach 1	15	-1.4	-0.4	0.8	015	A3	Varies
Brown Creek							
Reach 1	15,20	-2.2	-0.7	1.5	020	A4	Varies

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE
[3] ROUNDED TO THE NEAREST FOOT - SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

FLOOD INSURANCE ZONE DATA

WALLKILL RIVER, RIO GRANDE, QUAKER CREEK, BROWN CREEK

FLOODING SOURCE	PANEL [1]	ELEVATION DIFFERENCE [2] BETWEEN 1.0% (100 YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION [3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Otter Kill							
Reach 1	10	-2.0	-0.7	1.7	020	A4	Varies
Otter Kill Tributary 12							
Reach 1	10	-1.4	-0.4	0.9	015	A3	Varies
Black Meadow Creek							
Reach 1	10	-2.1	-0.7	1.7	020	A4	Varies

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE
[3] ROUNDED TO THE NEAREST FOOT - SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY
(ORANGE CO.)

FLOOD INSURANCE ZONE DATA

OTTER KILL, OTTER KILL TRIBUTARY 12
BLACK MEADOW CREEK

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Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the Town of Goshen.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Goshen is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

The Federal Insurance Administration has published a Flood Hazard Boundary Map for the Town of Goshen (Reference 17). This map contains a delineation of flood limits based on approximate methods and historical records of local flooding. The maps were used to verify flow lines developed for this Flood Insurance Study.

The United States Geological Survey has prepared a map of flood prone areas for the Town of Goshen and surrounding areas (Reference 18). This map was used to verify flow lines developed for streams studied in detail in this report.

The Soil Conservation Service (SCS) has prepared a report entitled Soils Interpretation Report for Orange County (Reference 19). This report delineates flood prone areas based on hydrologic soil groups within the Town of Goshen and surrounding areas. Information contained in the SCS Report was used to verify flood boundaries delineated in this Flood Insurance Study.

The United States Geological Survey has published a bulletin which contains the maximum known stages and discharges of New York streams through 1973 (Reference 7). Information for the Wallkill River and Quaker Creek included in this bulletin was used to verify hydrologic computations prepared for this Flood Insurance Study.

The U.S. Army Corps of Engineers, New York District has published flood plain information reports for the Wallkill River (Reference 8) and Quaker Creek (Reference 9) in the Town of Goshen. The hydraulic models prepared for the FPI reports were used as the basis of the hydraulic analysis of the streams for this Flood Insurance Study. The hydrologic and hydraulic analyses presented in the FPI report have been superseded by information prepared for this Flood Insurance Study.

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The Orange County Department of Public Works has published a flood plain information study for the Moodna Creek Basin (Reference 10). This study included an analysis of Otter Kill, Otter Kill Tributary 12, and Black Meadow Creek in the Town of Goshen. The hydraulic models prepared for the FPI report were used as the basis of the hydraulic analysis of the streams for this Flood Insurance Study. The hydrologic and hydraulic analyses presented in the FPI report have been superseded by information prepared for this Flood Insurance Study.

The Federal Emergency Management Agency has published a Flood Insurance Study for the Town of Wallkill (Reference 13), the Village of Florida (Reference 14), the Town of Hamptonburgh (Reference 15), the Village of Goshen (Reference 20), and the Town of Chester (Reference 21) which include adjoining or common reaches of streams studied in detail in the Town of Goshen. Hydrologic and hydraulic information prepared for the Town of Goshen is in agreement with the above referenced Flood Insurance Studies.

This study is authoritative for the purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region II Office, 26 Federal Plaza, Room 19-100, New York, New York, 10278.

8.0 BIBLIOGRAPHY AND REFERENCES

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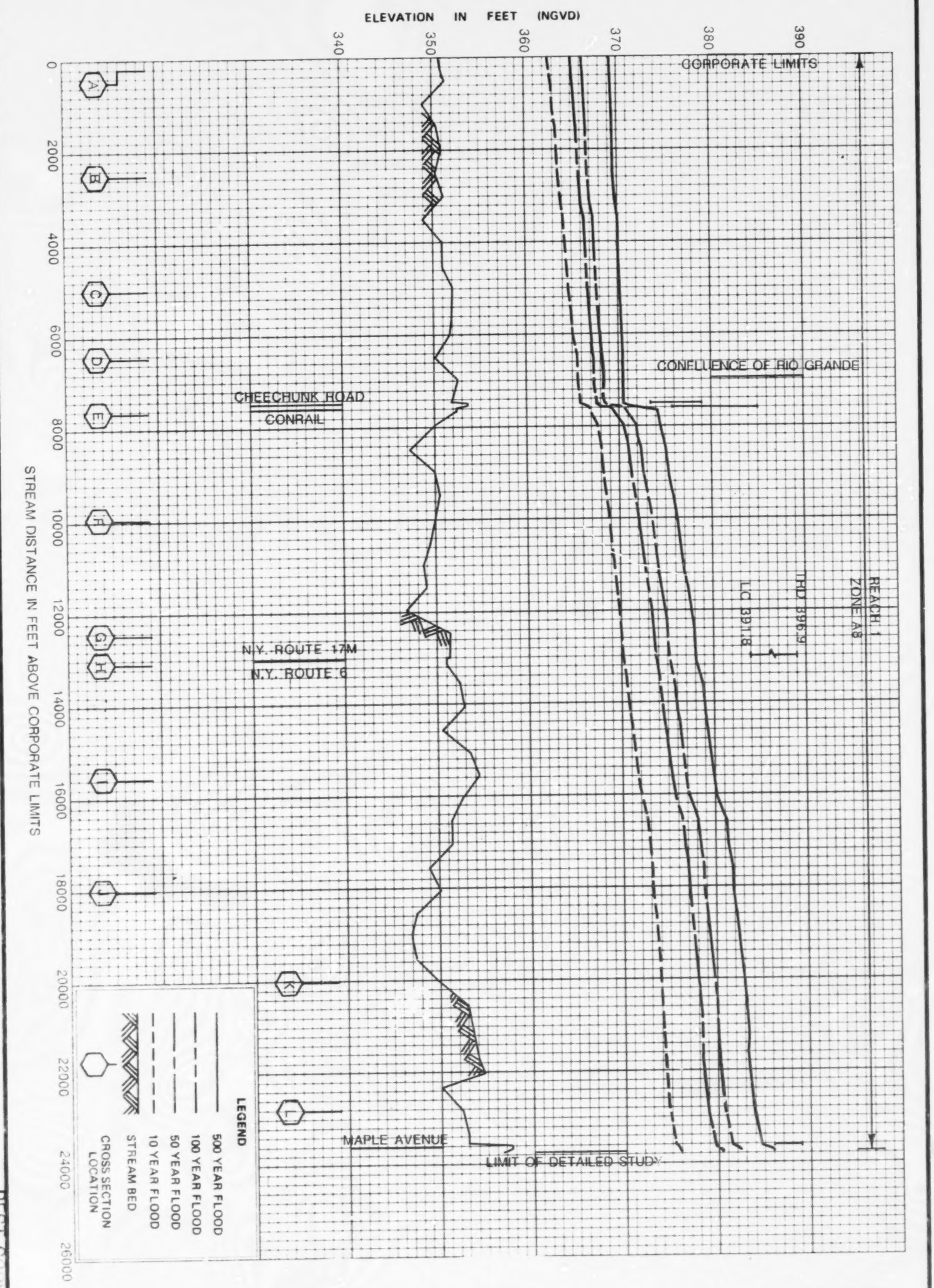

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

01P

FLOOD PROFILES

WALLKILL RIVER

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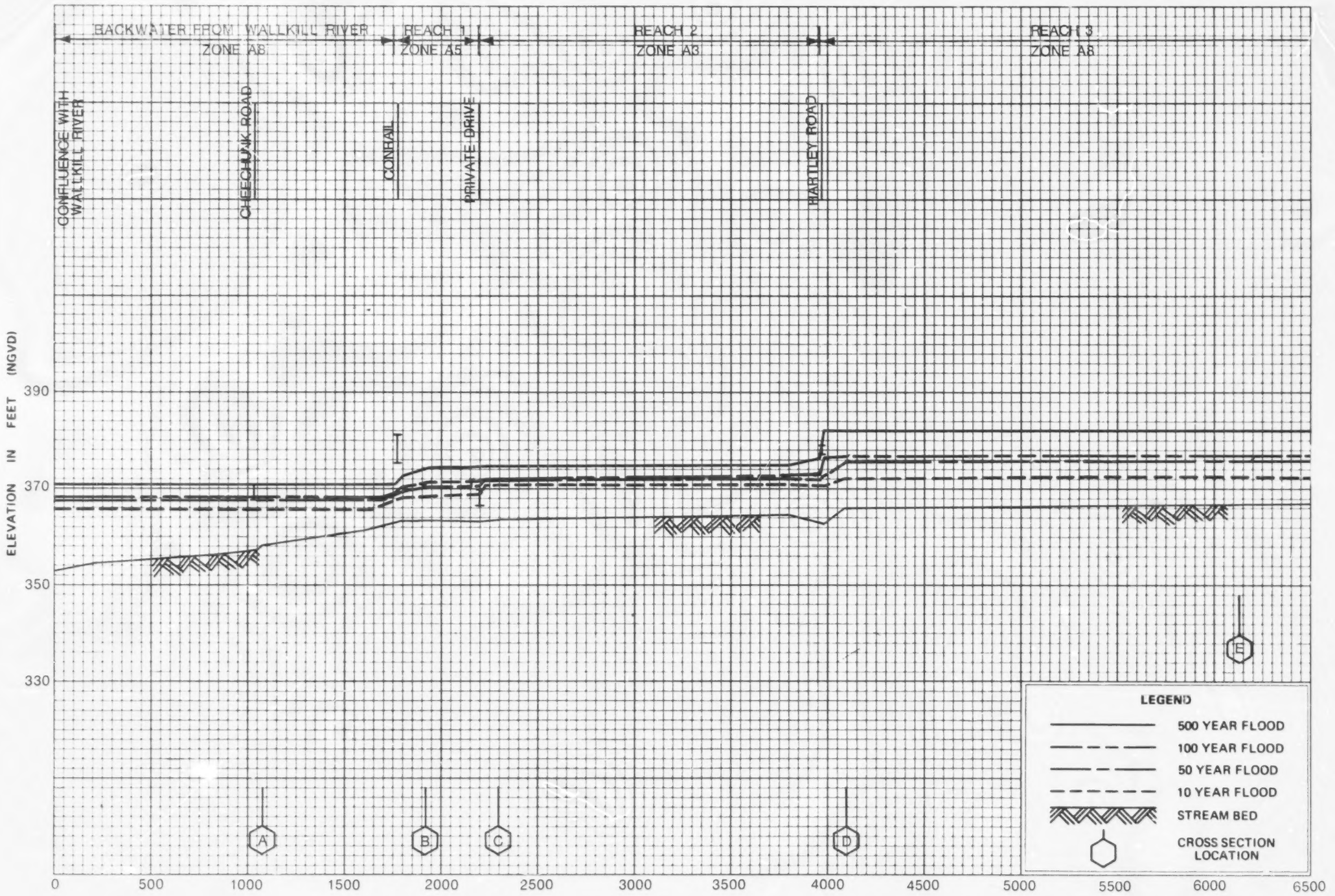

FLOOD PROFILES

RIO GRANDE

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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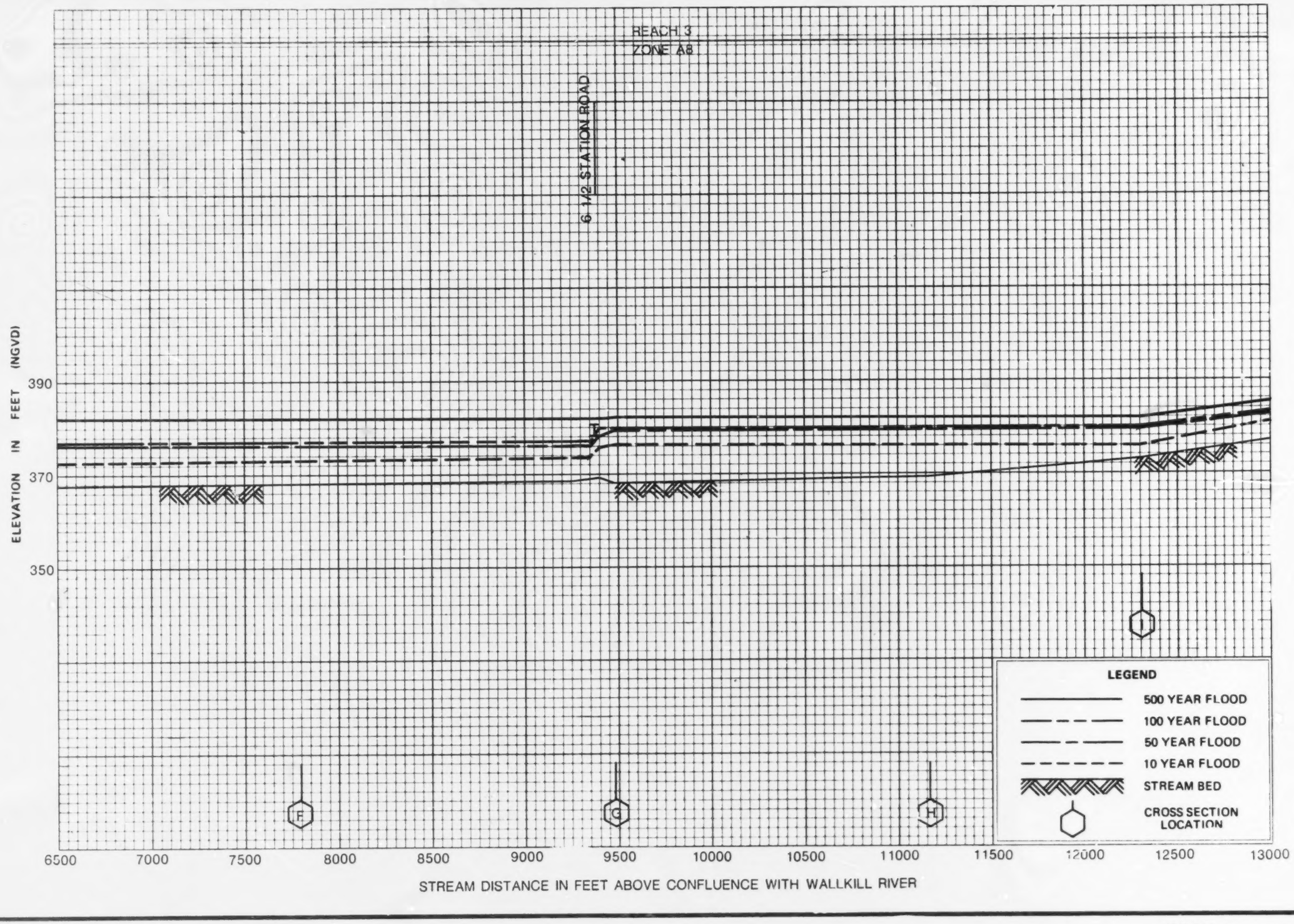

FLOOD PROFILES

RIO GRANDE

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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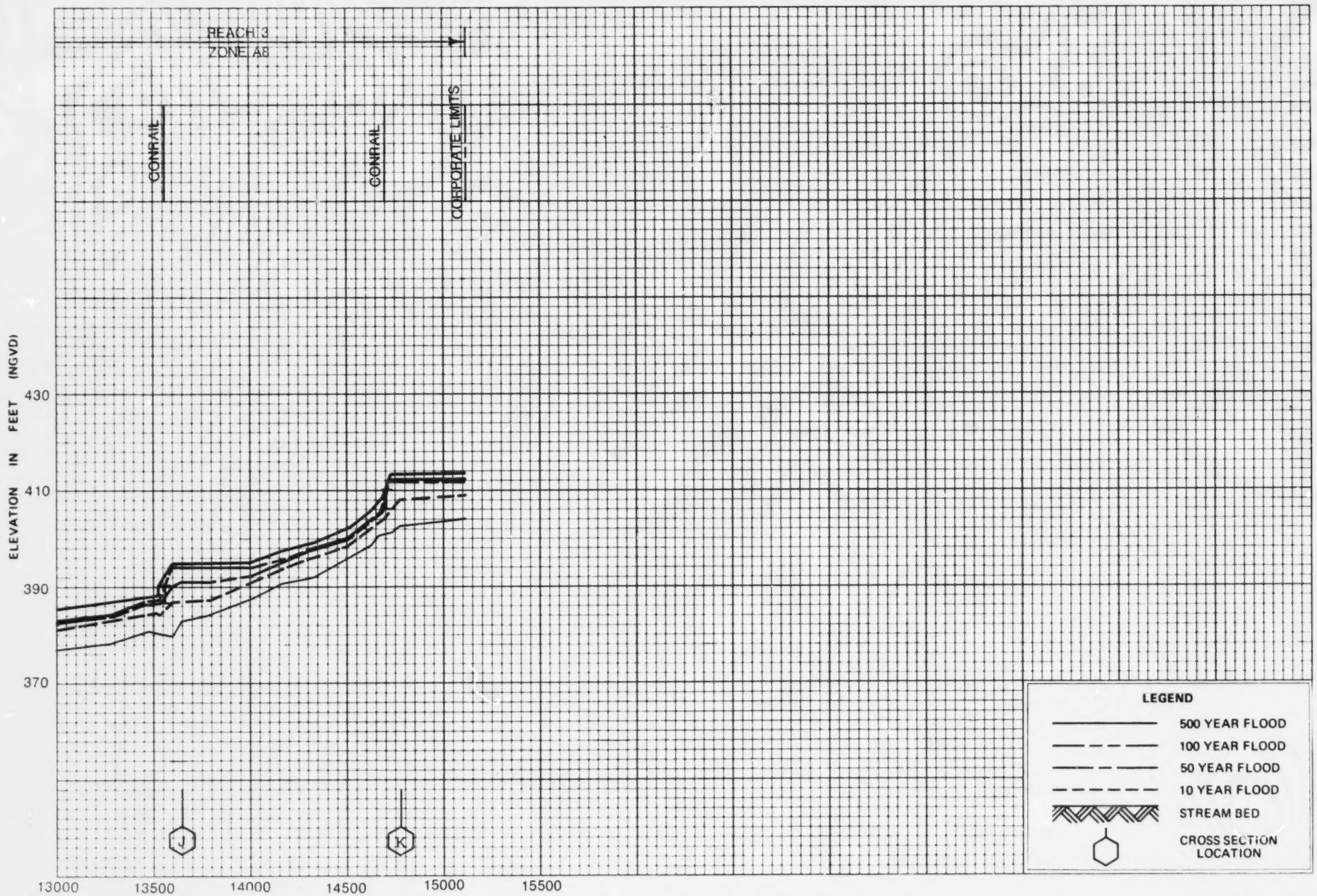

FLOOD PROFILES

RIO GRANDE

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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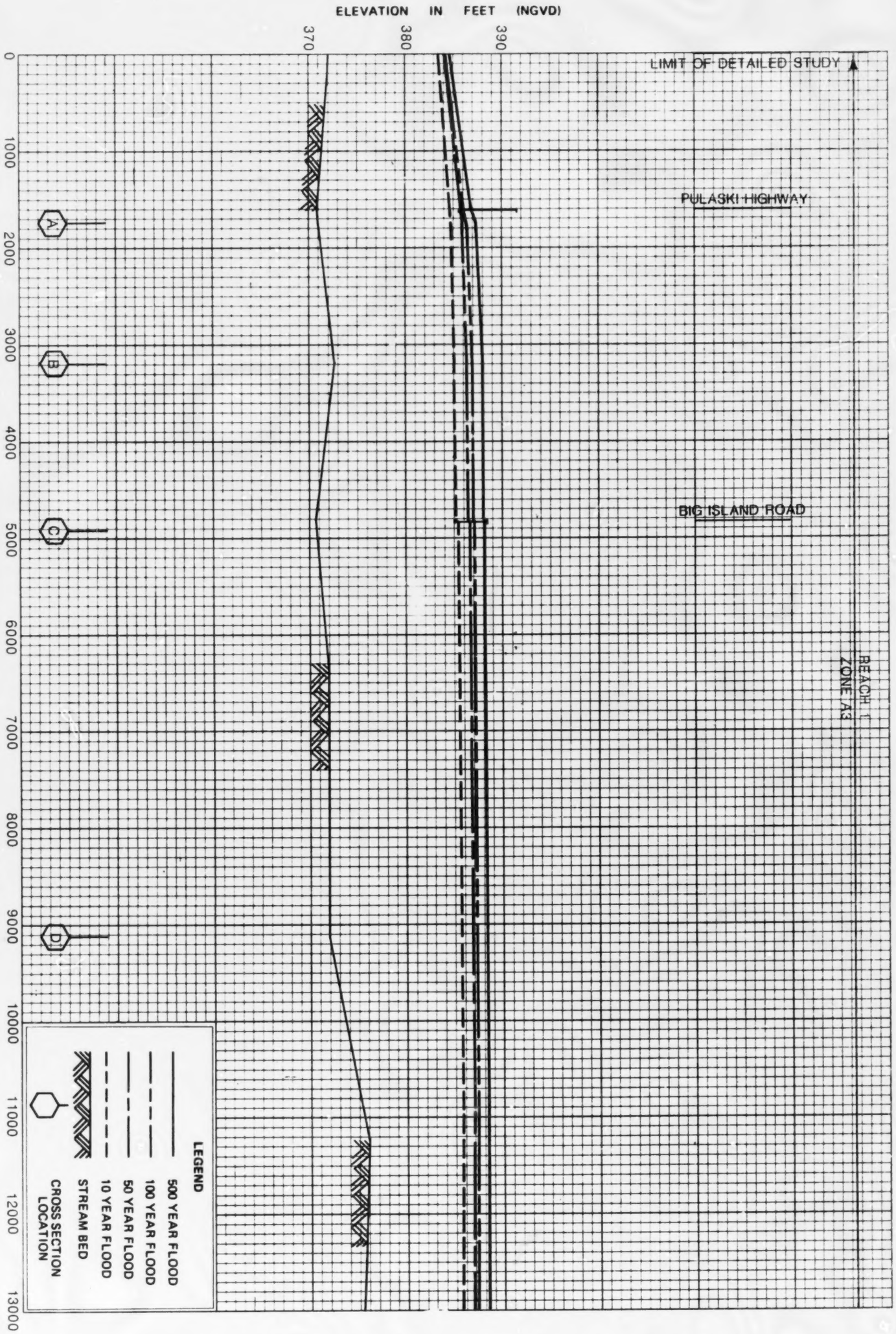

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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FLOOD PROFILES

QUAKER CREEK

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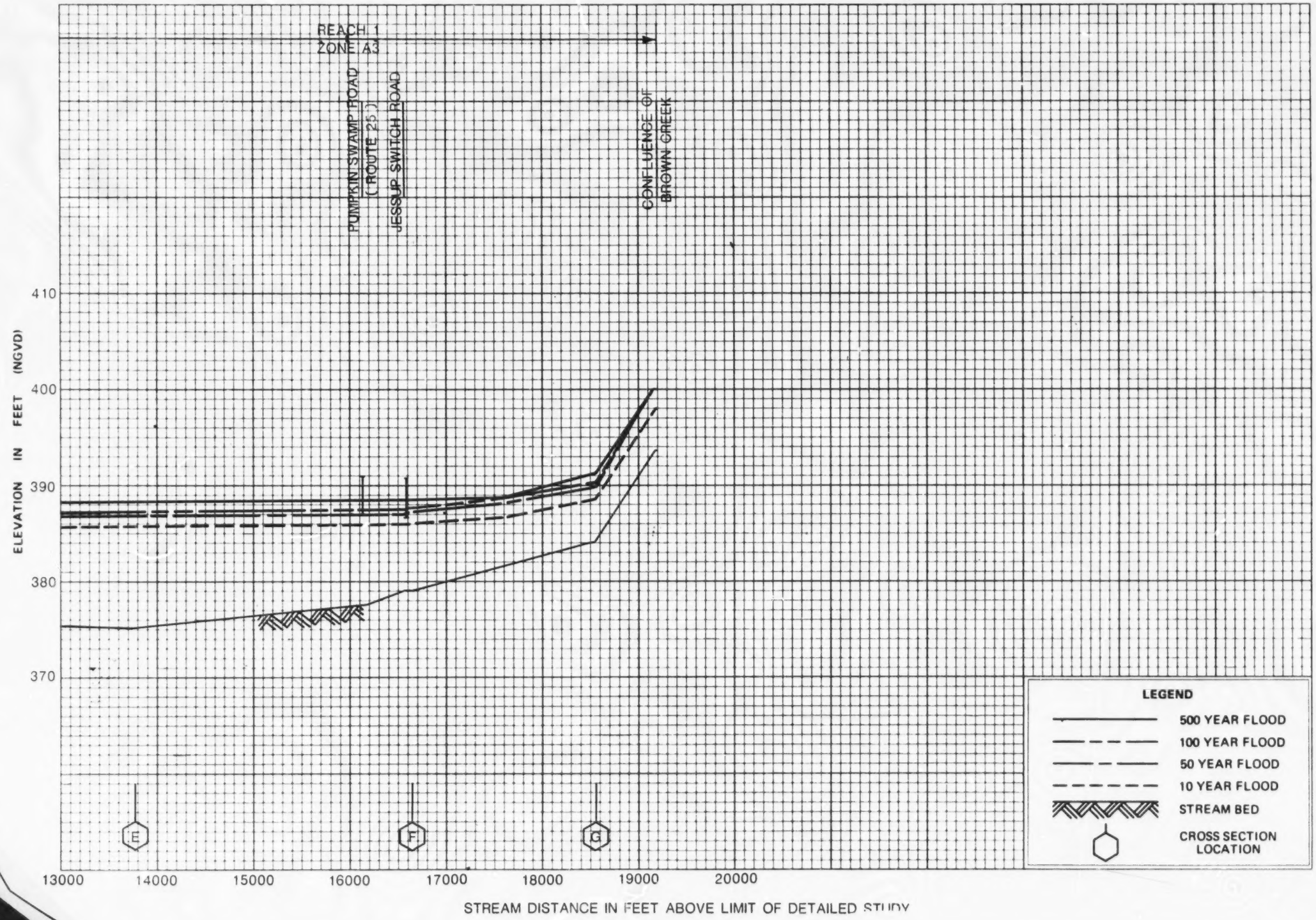

FLOOD PROFILES

QUAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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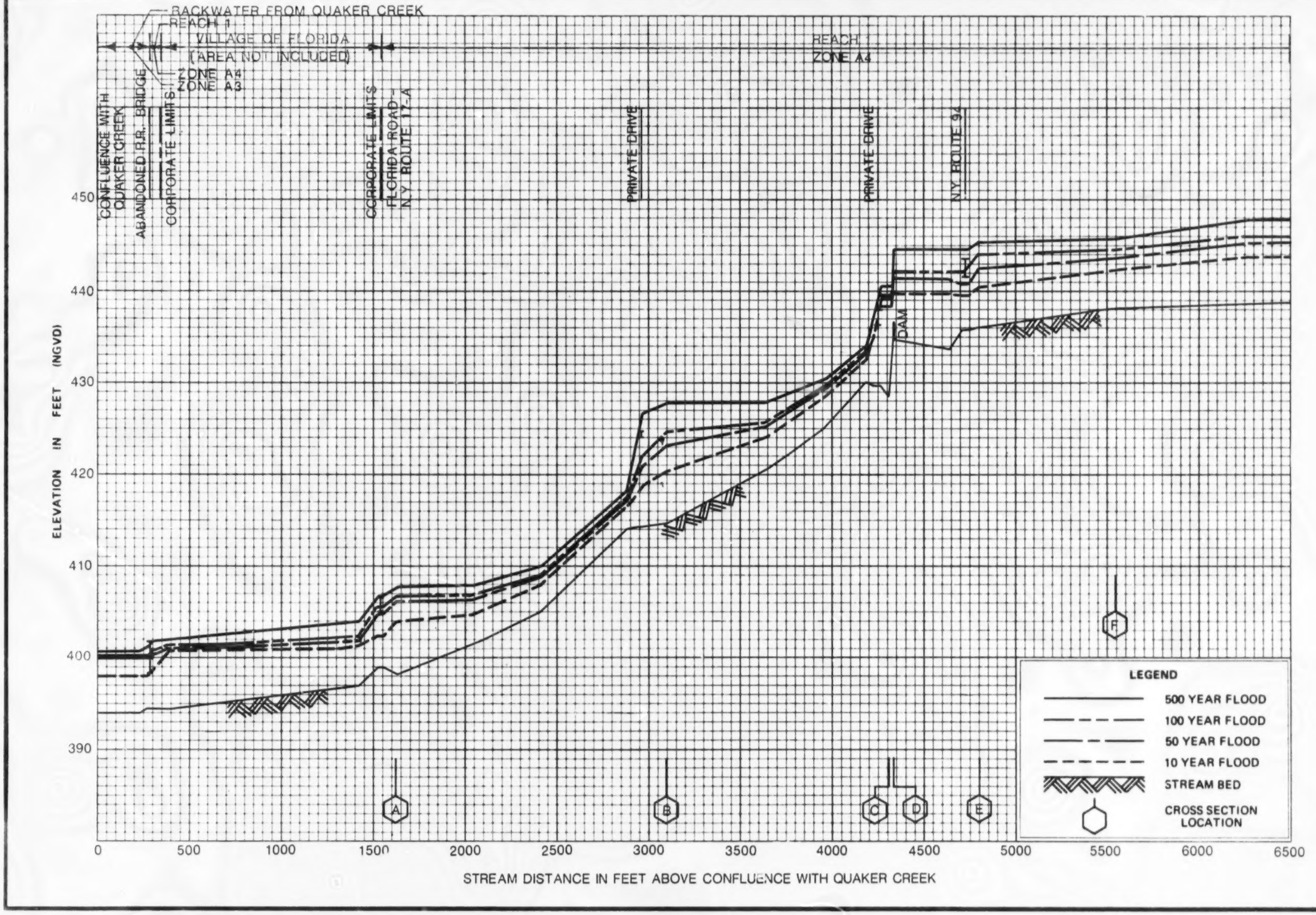

FLOOD PROFILES

BROWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

07P

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FLOOD PROFILES

BROWN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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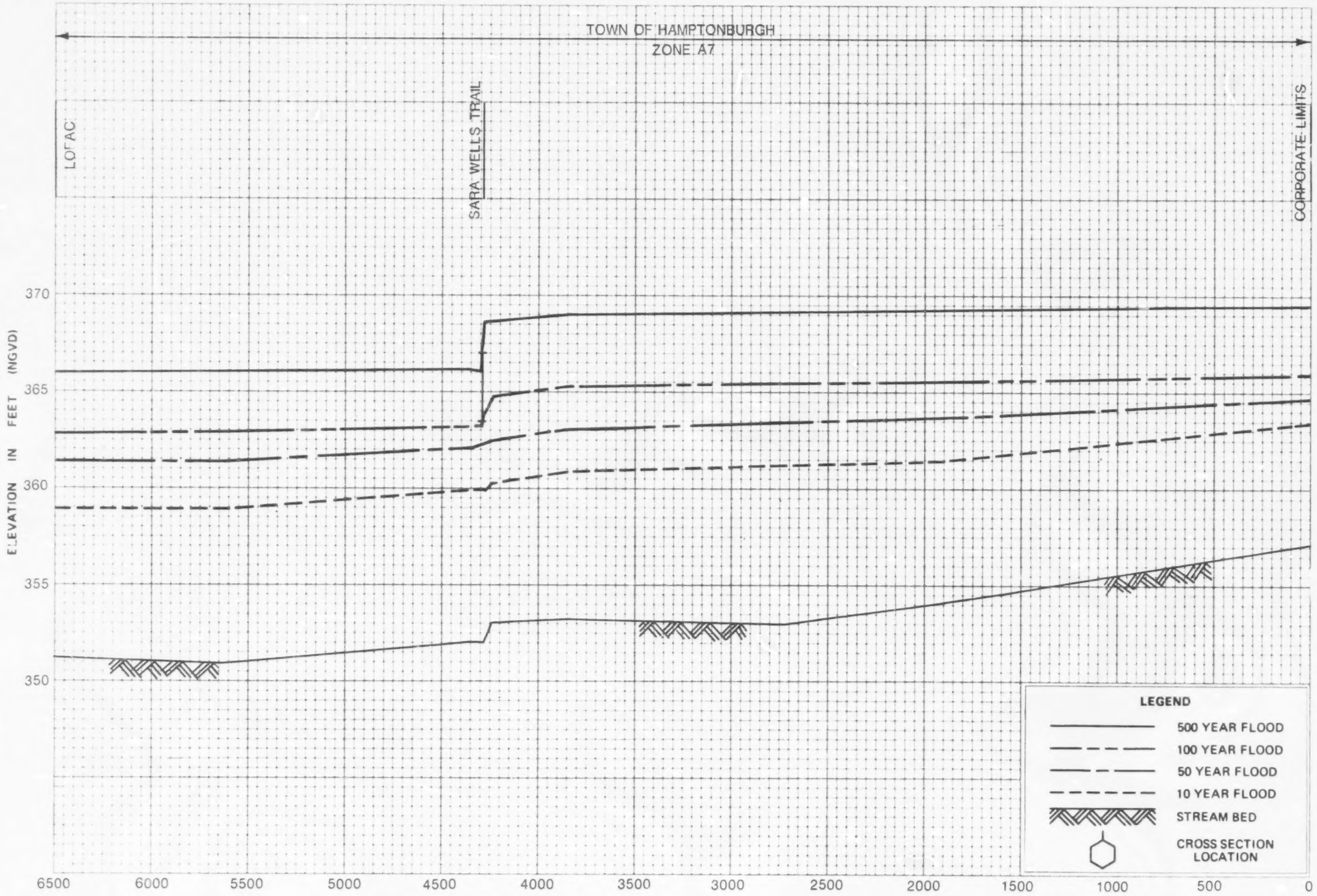

FLOOD PROFILES

OTTER KILL

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

09P

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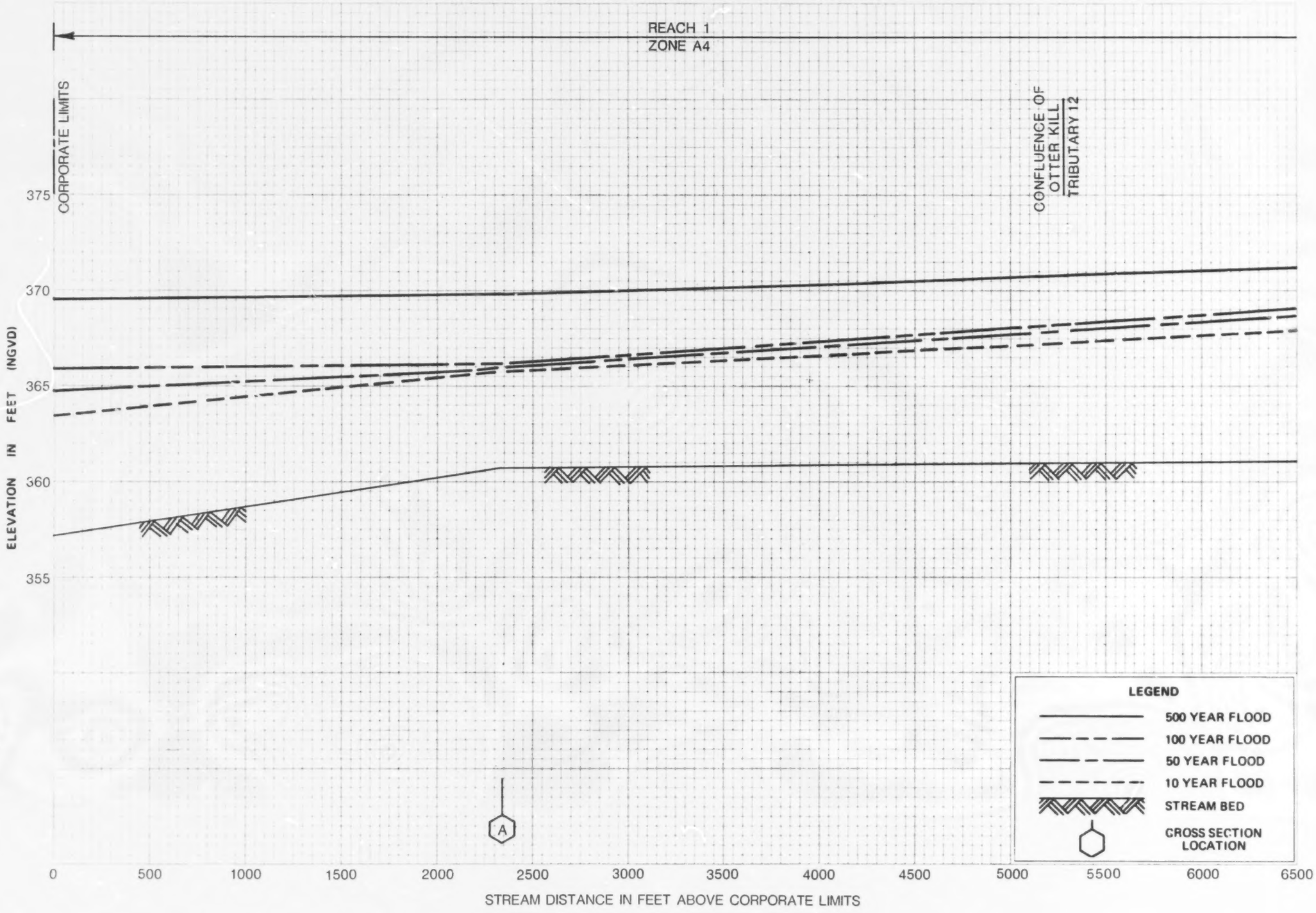

FLOOD PROFILES

OTTER KILL

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO)

10P

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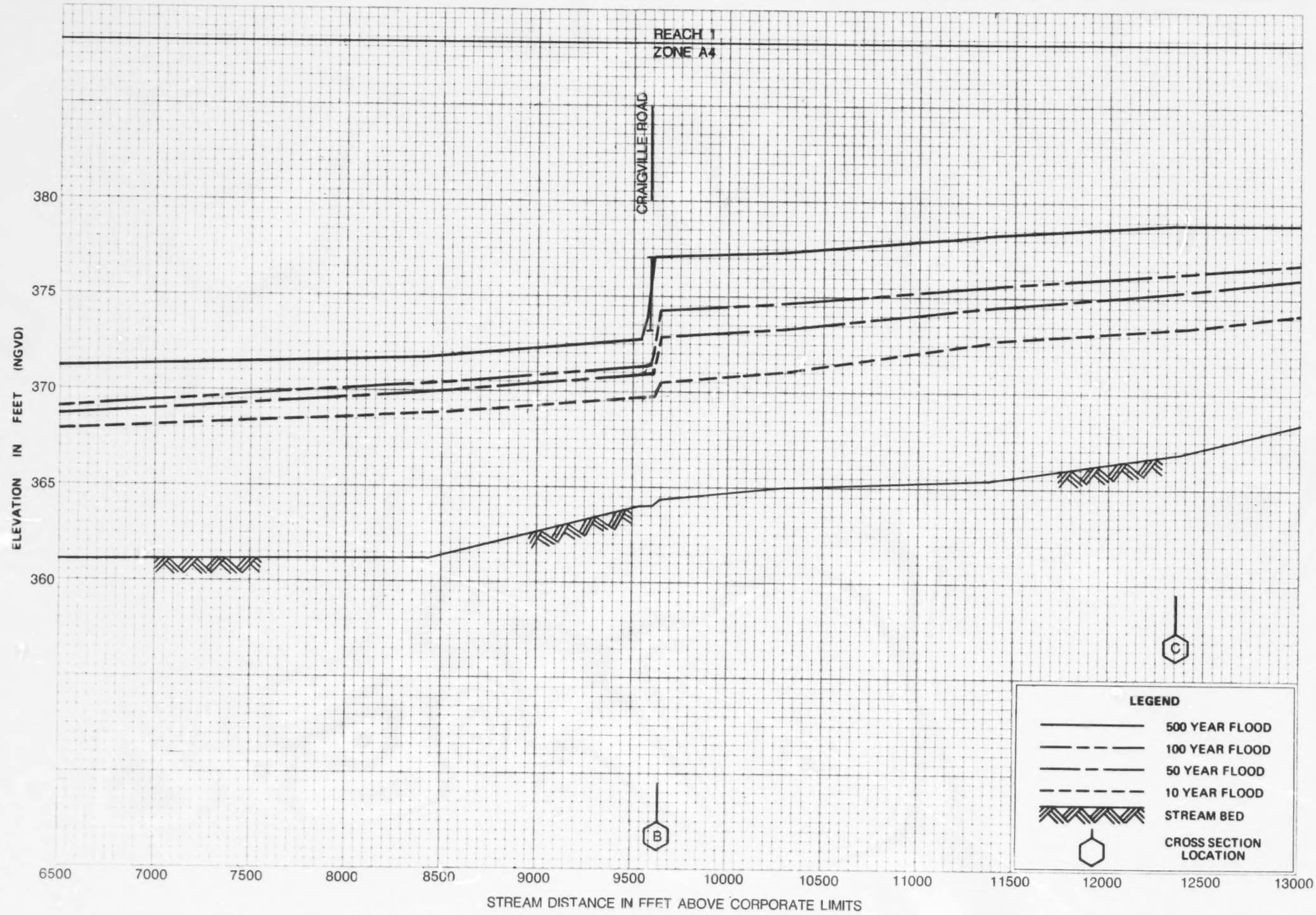

FLOOD PROFILES

OTTER KILL

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO)

11P

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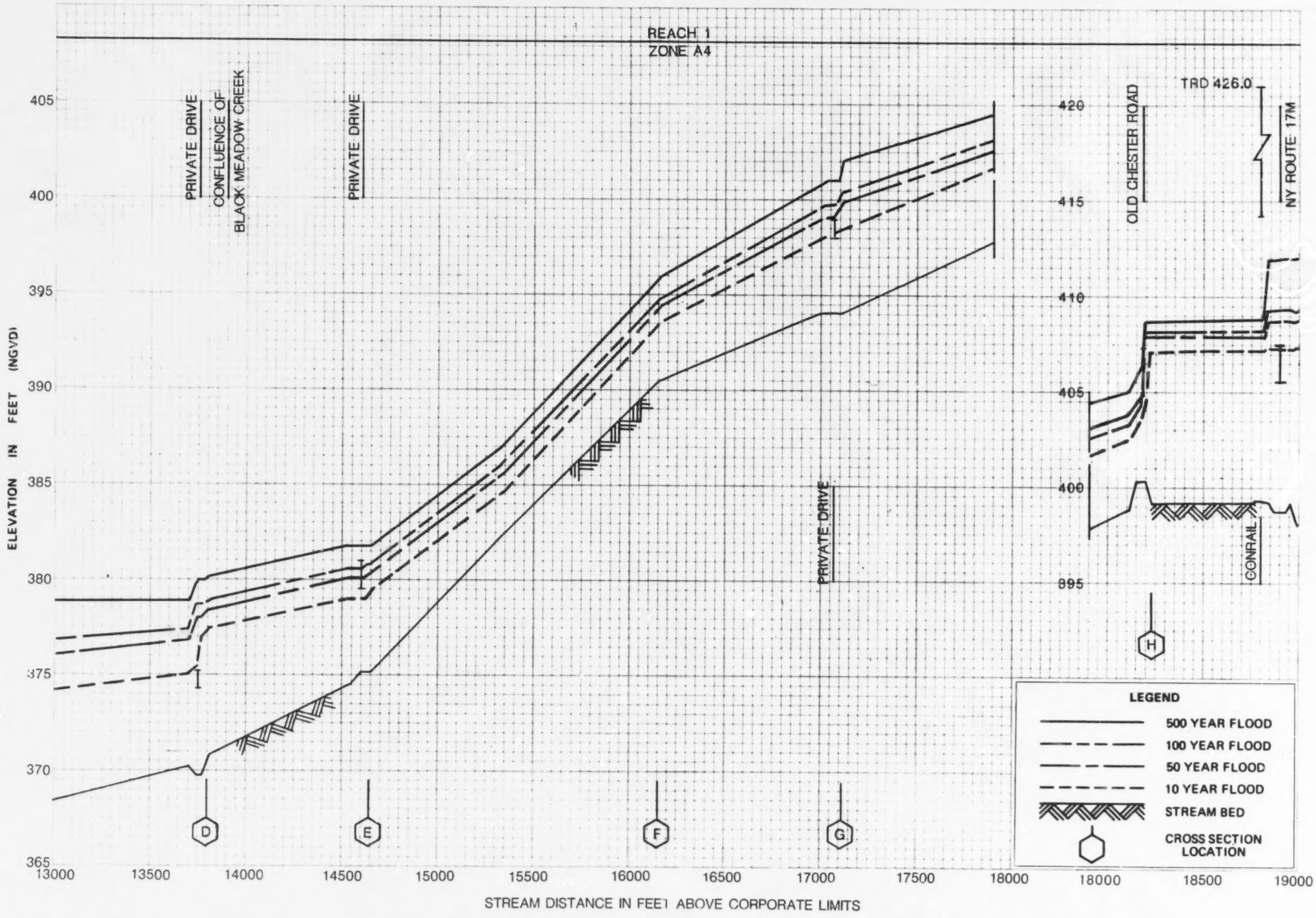

FLOOD PROFILES

OTTER KILL

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

12P

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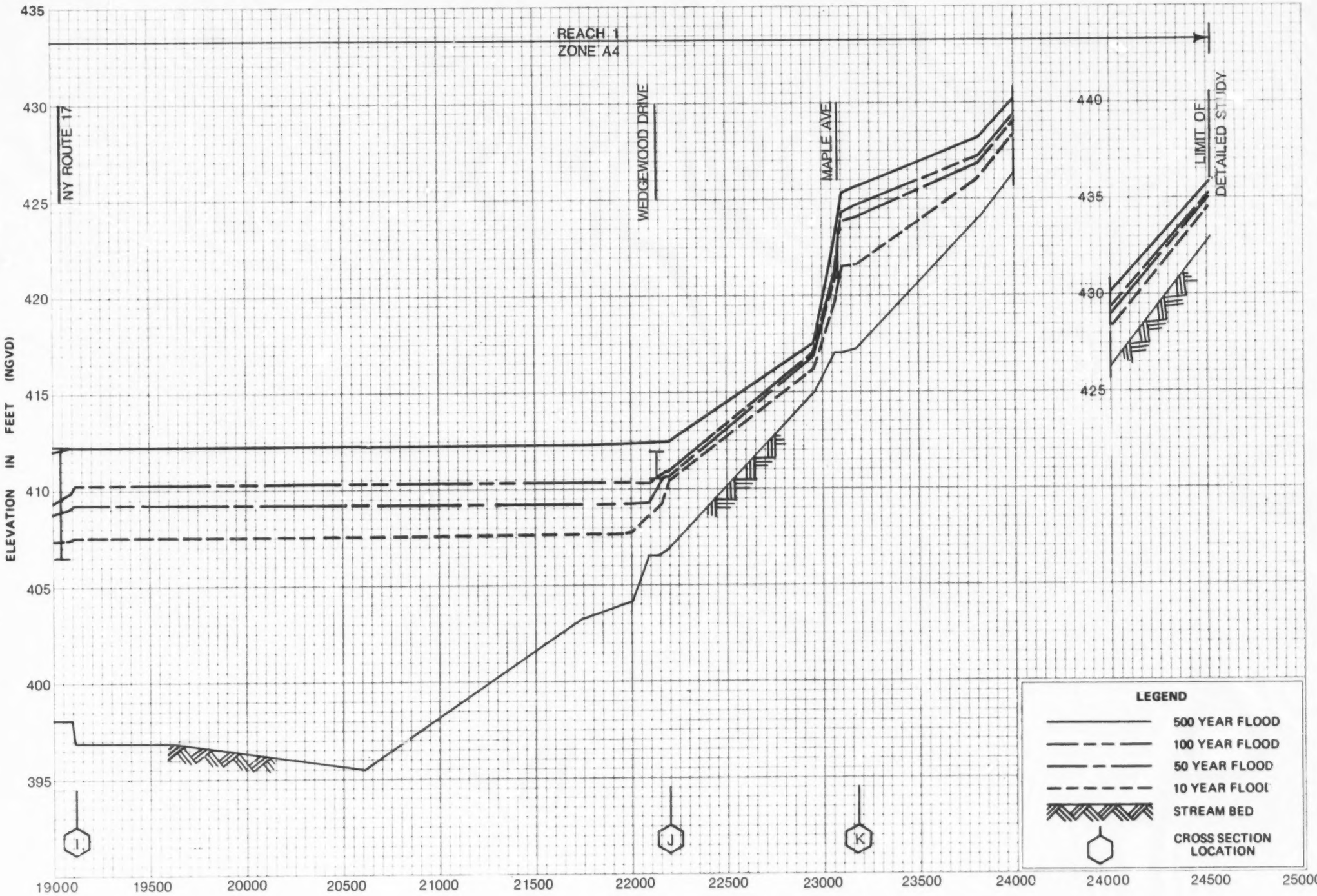

FLOOD PROFILES

OTTER KILL

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.

13P

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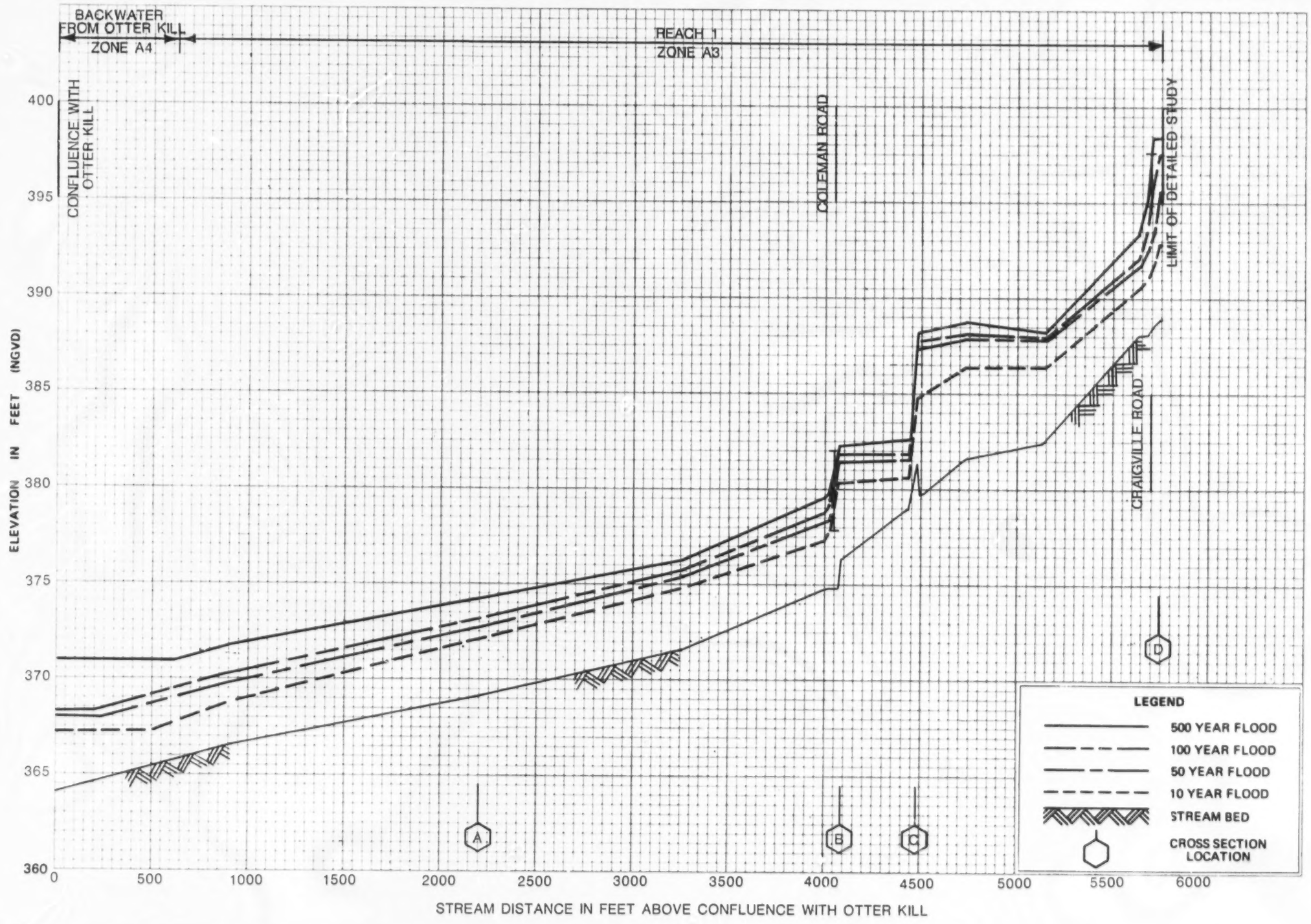

FLOOD PROFILES

OTTER KILL TRIBUTARY 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

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REACH 1
ZONE A4

CONFLUENCE WITH OTTER KILL

OLD CHESTER ROAD

TRD 418.9

CONRAIL

ELEVATION IN FEET (NGVD)

400
395
390
385
380
375
370
365

405
400
395
390

A
B
C

LEGEND
- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 5500 6000

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH OTTER KILL

FLOOD PROFILES

BLACK MEADOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY
(ORANGE CO.)

15P

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REACH 1
ZONE A4

CORPORATE LIMIT

ELEVATION IN FEET (NGVD)

410
405
400
395
390

D

6000 6500 7000 7500 8000 8500 9000 9500

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH OTTER KILL

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

BLACK MEADOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF GOSHEN, NY

(ORANGE CO.)

16P

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